

erroneous detection to realize few highly sensitive image monitors.

[0076]They are a high speed and the composition of having usually added the detection invalid zone setting-out means 303 to the 1st example as the second example of the moving body detecting means 104 of speed. The detection invalid zone setting-out means 303 The newest image of the time series picture holding mechanism 102, The existence of reflection by the roughness of the local wave in a surveillance object field is judged from the noise generation state of the averaging picture of the averaging preparing means 103, and the pre-surveillance cycle of a detection object effective invalid judging means, in the rude portion of a wave, the binarization threshold of the object detection means 304 is made high, and generating of erroneous detection can be prevented.

[0077]In a portion with reflection, generating of erroneous detection is prevented by setting up not detect thoroughly. Detection of the invading object to said reflection field is suppliable with the silhouette object detection means 105.

[0078]The example of the detection invalid zone setting-out means 303 of operation is shown in drawing 6. Drawing 6 (a) is a screen of a surveillance object field, 601 is a quay portion without fluctuation, and the other portion is a portion into which a wave swings. If processing is added for the picture of a surveillance object field by the averaging image creating means 103 and an averaging picture is created, the portion of the field 601 carries out the same luminance distribution as the correspondence part of a surveillance object field, and swinging portions other than field 601 are the average luminance of an applicable portion, and if there is no reflection, they will become almost uniform luminosity.

[0079]If binarization is carried out with a predetermined threshold after continuing for two or more cycles and accumulating luminance difference distribution of an averaging picture and the picture of a surveillance object field for every surveillance cycle, as shown in drawing 6 (b), the field 602 corresponding to 601 will be black, and the other field will become white. Since a white domain is an intense portion of the luminosity change by fluctuation, it sets up the detection threshold of the object detection means 304 highly, and can prevent erroneous detection.

[0080]On the other hand, since a black field is a small portion of luminosity change, even if the detection threshold of the object detection means 304 is set up low and it raises detection sensitivity, possibility of an incorrect alert can be made low. It is a white domain and the portion whose luminance value of an averaging picture is higher than a predetermined value can also suspend processing of the object detection means 304 as a portion which has generated reflection.

[0081]There is an effect which controls erroneous detection without dropping detection sensitivity on taking the above composition, since it succeeds in the optimal adjustment for each field even if the intense portions of fluctuation or reflection are in 1 screen.

[0082]Next, the details of the first example of the silhouette object detection means 105 are explained based on drawing 7.

[0083]In drawing 7, the silhouette object detection means 105 comprises the silhouette area detection means 701 and the object detection means 702. By the silhouette area detection means 701, the field more than predetermined luminosity is chosen by the averaging picture by the averaging image creating means 103.

[0084]Carry out binarization of the newest image of the time series picture holding mechanism 102 by making another predetermined luminosity into a threshold in the field more than predetermined luminosity, and let the field where luminosity is low be a silhouette object candidate. The object detection means 702 is made into the invading object candidate who silhouette-ized the silhouette object candidate by the silhouette area detection means 701, and is outputted from the silhouette object detection means 105. It is effective in the ability to catch the silhouette-ized invading object without a relation to the movement speed by taking the above composition.

[0085]Depending on a monitor area, a building may exist in a surveillance object field, these will also be silhouette-ized in the state of a backlight, and he will be the invading object candidate who silhouette-ized in the first example of the silhouette object detection means 105. Then, the second example of the silhouette object detection means 105 is the composition of having added the reference image preparing means 703 and the detection invalid zone setting-out means 704 to the composition of the first example.

[0086]if the image in which an invading object does not exist is inputted from the camera 102 in advance of monitoring operation -- the first example -- said -- since what the building in this monitor area silhouette-ized like is detected, it holds to the reference image preparing means 703 by making this into a reference image. The detection invalid zone setting-out means 704 outputs the field of a building as an invalid zone with the reference image which the reference image setting-out means 703 holds.

[0087]The object detection means 702 is outputted as an object which silhouette-ized the thing excluding the invalid zone of the detection invalid zone setting-out means 704 from the silhouette ghost object by the silhouette area detection means 701 at the time of surveillance operation.

[0088]Even when a building etc. are in a monitor area and these silhouette-ize by taking the above composition, it is effective in the ability to catch an invading object without erroneous detection.

[0089]However, if light sources, such as the sun, move with time, the shadow of a building will also move. Then, the third example of the silhouette object detection means 105 is the composition of having added the updating period generating means 705 to the composition of the second example.

[0090]The updating period generating means 705 is conveyed to the reference image

preparing means 703 as a renewal signal, only when a signal is made with the time interval decided beforehand and the invading object does not exist. If a renewal signal comes, the reference image preparing means 703 will make this a detection invalid zone for the output of the silhouette area detection means 701 in this time henceforth as a new reference image next time till updating.

[0091]It is effective in the ability to catch an invading object, without carrying out erroneous detection, even if how for a silhouette to be made with movement of a light source by taking the above composition changes.

[0092]Next, "a low speed and the standstill object detection means 106" are written as the object detection means 106, and the details of the first example of the object detection means 106 are explained based on drawing 8.

[0093]If the monitor video image currently continuously changed like waves is processed by the averaging image creating means 103, the variation part of luminosity will become a scarce picture of a motion from which it is equalized in time and light and darkness change gently also spatially. If the invading object is standing it still in a field, in an operation of averaging processing, the luminance distribution of an invading object will become the picture with a sufficient signal noise ratio carried out distinctly. When an invading object moves at a low speed, the picture of an invading object carries out dotage, but the luminance distribution carried out more clearly than the wave always changed appears.

[0094]The object detection means 106 is a means to detect the invading object which used this character, and has moved or stopped at a low speed, and comprises the spatial differentiation processing means 801 and the object detection means 802. The spatial differentiation processing means 801 is the processing which detects the field which changes luminosity rapidly spatially, and performs difference processing of adjoining pixels. A publicly known differential operator may be made to act on a change of difference processing. After emphasizing the field which changes luminosity a lot spatially by the above technique, binarization is carried out with a predetermined threshold and an object is detected.

[0095]The object detection means 802 is outputted from a low speed and the standstill object detection means 106 by making into a low speed or a stopped invading object candidate the object which the spatial differentiation processing means 801 detected. It is effective in an invading object with few motions than fluctuation of a background being detectable by taking the above composition.

[0096]Depending on a monitor area, a building may exist in a surveillance object field, by an averaging picture, luminance distribution will clarify and these will also be detected as an object candidate. Then, the second example of a low speed and the standstill object detection means 106 is the composition of having added the reference image preparing means 803 and the detection invalid zone setting-out means 804 to the composition of the first example.

[0097]if the image in which an invading object does not exist is inputted from the camera 102 in advance of monitoring operation -- the 1st example -- said -- since that from which the building in this monitor area changes a lot like is detected, it holds to the reference image preparing means 803 by making this into a reference image. The detection invalid zone setting-out means 804 outputs the field of a building as an invalid zone with the reference image which the reference image preparing means 803 holds.

[0098]The object detection means 802 outputs the thing excluding the invalid zone of the detection invalid zone setting-out means 804 from the detection object by the spatial differentiation processing means 801 as an object under a low speed and stop at the time of surveillance operation. It is effective in an invading object being detectable, without carrying out erroneous detection of these, even if there are a building, a rock, etc. which were controlled in the detection area by taking the above composition.

[0099]A wave is filled and the luminance pattern of a building changes with length. Then, the third example of the object detection means 106 is the composition of having added the updating period generating means 805 to the composition of the second example. The updating period generating means 805 is conveyed to the reference image preparing means 803 as a renewal signal, only when a signal is made with the time interval decided beforehand and the invading object does not exist. If a renewal signal comes, the reference image preparing means 803 will make this a detection invalid zone for the output of the spatial differentiation processing means 801 in this time henceforth as a new reference image next time till updating. It is effective in the ability to catch an invading object, without carrying out erroneous detection of these by taking the above composition, even if a building, a rock, etc. change with time.

[0100]Next, drawing 9 explains operation of the environmental analysis means 108. The occurrences per a high speed and unit time of the object which was not chosen with a detection object though usually detected by the moving body detecting means 104 of speed are calculated (Step 1). The number beforehand decided to be a counting result of Step 1 is compared, when there are more occurrences, it progresses to Step 2, it is few, or when the same, it progresses to Step 3.

[0101]Since it is a high speed and when [the case where the thing with many noises has the large fluctuation of a wave etc., and when reflection by a backlight is bright] in the moving body detecting means 104 of speed, these information is usually displayed by the displaying means 111 (Step 2). When the detection object selecting means 107 is in automatic switchover mode, a high speed and area of a cancellation field which usually repeals extensively the output of the moving body detecting means 104 of speed, and displays that on the displaying means 111, or the detection invalid zone setting-out means 303 sets up are extended (Step 2).

[0102]When the luminosity of the averaging picture of the averaging picture 103 is high, it judges that reflection has occurred in the state of a backlight, and that is displayed on the displaying means 111 (Step 2). Though detected by the silhouette object detection means 105, the occurrences per unit time of a detection object and the object which was not chosen are calculated (Step 3). The number beforehand decided to be a counting result of Step 3 is compared, when there are more occurrences, it progresses to Step 4, it is few, or when the same, it progresses to Step 5.

[0103]It is because the thing with many noises has the unsuitable reference image of the reference image preparing means 703 for silhouettes in connection with movement of a light source in the silhouette object detection means 105, and said reference image is updated and these information is displayed by the displaying means 111 (Step 4). Though a low speed and the standstill object detection means 106 detect, the occurrences per unit time of a detection object and the object which was not chosen are calculated (Step 5). The number beforehand decided to be a counting result of Step 5 is compared, when there are more occurrences, it progresses to Step 6, it is few, or when the same, it ends.

[0104]The shadow of a building etc. changes with movement of a light source by the low speed and the standstill object detection means 106, it is because the thing with many noises has the unsuitable reference image of the reference image preparing means 803, and it updates a reference image and it displays these information by the displaying means 111 (Step 6).

[0105]Since it is adjusted automatically to the processing which suited the present environment of the surveillance object by taking the above composition and an operation situation is displayed, it is easy to treat for a hitcher on, and, moreover, faults, such as failure, are also effective in finding it at an early stage and being easy to respond.

[0106]Next, the details of the object tracing means 109 are explained. Based on drawing 10, the difference between the object tracing method of the object tracing means 109 and the conventional object tracing method is explained.

[0107]Drawing 10 (a) is a figure showing the conventional object tracing method, and shows in piles the object 1001 detected by the present frame, and the object 1002 detected by the previous frame on the same screen. It wrote A [the center of the object 1001 or the circumscribed rectangle center of the object 1001], and it writes B [the center of the object 1002 or the circumscribed rectangle center of the object 1002]. The vector AB which connects the center A and the center B with the conventional object tracing method was considered as movement of an object inter-frame [said].

[0108]Drawing 10 (b) is a figure showing the object tracing method of the object detection means 109, and shows in piles the object 1001 detected by the present

frame, and the object 1002 detected by the previous frame on the same screen.

[0109]It wrote A [the center of the object 1001 or the circumscribed rectangle center of the object 1001], and it writes B [the center of the object 1002 or the circumscribed rectangle center of the object 1002]. The vector 1003 is a vector showing movement of this object to a previous frame. C shows the intersection points of the line segment developed in parallel with the vector 1003 from the center or the circumscribed rectangle center A of the object 1001, and the outline of the object 1001 or a circumscribed rectangle outline. D shows the intersection points of the line segment developed in parallel with the vector 1003 from the center or the circumscribed rectangle center B of the object 1002, and the outline of the object 1002 or a circumscribed rectangle outline. At this time, vector DC which connects D and C is considered as movement of said inter-frame object.

[0110]Although the inter-frame objects 1001 and 1002 do not change a form like a rigid body in the example of drawing 10, When pursuing the marine vessel which raises the flying object which moves while taking out smoke, such as a rocket and a missile, and wave splash, and navigates, Since it detected as an object also including smoke or splash, the centers A and B are not necessarily centers of a movable matter object itself in many cases, and there was a problem which cannot measure movement of this object correctly in a conventional method.

[0111]On the other hand, since the object tracing means 109 has always caught the tip of the move direction of this movable matter object, a possibility of pursuing the movable matter object itself is high, and can measure the move direction of this object correctly. Immediately after an objective pursuit start, since the movement vector 1003 which should be referred to is not obtained, ask for a movement vector by the conventional method, but the object tracing means 109. It asks for the objective move direction tip by making the average of the movement vector covering this movement vector or multiple frame into the reference vector 1003, and a movement vector is measured.

[0112]The above explains operation in case two or more detection objects exist based on drawing 11, although it is a method of pursuing in case the number of detection objects is one.

[0113]Drawing 11 (a) is a case where a detection object moves at a low speed, the object 1001 and the object 1101 are objects detected by the present frame, and the object 1002 is an object detected by the previous frame. E is the center or the circumscribed rectangle center of the detection object 1101, and F is the point that the outline of the line segment developed in the direction of the movement vector 1003 and the object 1101 crosses.

[0114]Since an object is a low speed, the movement vector 1003 called for in pursuit to a previous frame is small, and its reliability of the move direction is low. Then, collation of an inter-frame object makes things with a near distance compare. For

example, the detection objects 1002 are the objects 1001 and 1101 as a candidate who moves by a next frame. Although the object which agrees with the direction of the movement vector 1003 is 1001, when the movement vector 1003 is small, it matches the minimum object of distance, i.e., 1101, and makes the vector BE or vector DF the vector of new movement.

[0115]On the other hand, drawing 11 (b) is a case where a detection object moves at high speed, the object 1001 and the object 1102 are objects detected by the present frame, and the object 1002 is an object detected by the previous frame. G is an intersection of the line segment developed in the direction of the movement vector 1003 through the center or the circumscribed rectangle center of the detection object 1102, and the outline of the object 1102. At this time, the vector DG or vector DC is thought as an inter-frame movement vector.

[0116]Generally the object under high speed movement cannot change the move direction rapidly. If this is taken into consideration, vector DC will be chosen as the movement vector 1003 to a previous frame as what has a near direction and size, therefore it will be judged that the object 1002 of the previous frame moved to the object 1001 by the present frame.

[0117]An example of the object tracing means 109 which carries out the above operation is shown in drawing 12.

[0118]The object tracing means 109 comprises the circumscribed rectangle setting-out means 1201, center coordinates and the tip-coordinates measurement means 1202, the movement vector evaluation methods 1203, the movement vector selection means 1204, center coordinates, tip coordinates and the movement vector holding mechanism 1205, and the object coordinates output means 1206.

[0119]In the circumscribed rectangle setting-out means 1201, the binary picture of the detection object selecting means 107 is processed, and the circumscribed rectangle of a detection object is set up. A circumscribed rectangle is a rectangle in which an object is inscribed. In center coordinates and the tip-coordinates measurement means 1202, said circumscribed rectangle center coordinates are searched for, and tip coordinates are measured based on the movement vector to the previous frame of center-coordinates, tip-coordinates, and movement vector holding mechanism 1205 maintenance.

[0120]In the movement vector evaluation methods 1203, all possible movement vectors are calculated using center coordinates, tip coordinates, the circumscribed rectangle center coordinates of a previous frame that the movement vector holding mechanism 1205 holds, tip coordinates, the center coordinates of a present frame, and tip coordinates. The movement vector selection means 1204 selects a suitable movement vector according to the size of the movement vector to a previous frame, i.e., the speed of a movable matter object, which center coordinates, tip coordinates, and the movement vector holding mechanism 1205 hold. From the selected movement